CSTAR Activities at the University of Utah

John Horel
john.horel@utah.edu

1996-2007: NOAA Cooperative Institute for Regional Prediction. Co-PIs Horel and Steenburgh

2007-2010: Improved Monitoring, Analysis, and Prediction of High Impact Weather. Co-PIs John Horel, Jim Steenburgh, David Whiteman

***2010-2013**: Advancing Analysis, Forecast and Warning Capabilities for High Impact Weather Events. Co-PIs John Horel & Jim Steenburgh*

Transfer of Applied Research To Operations

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- MesoWest is a successful example of R&D supported by CSTAR
  - MesoWest is more than one of the many data pipes to MADIS
  - MySql relational database of current and archived data, metadata, software, and web displays integral to WFO office and IMET operations
- Evaluating the utility of mesonet observations for use in surface analyses and verification efforts (Myrick and Horel 2008; Horel and Dong 2010)
- Participating in the development and evaluation of the RTMA (Tyndall 2008; Tyndall et al. 2010)
- Quantitative forecasting of snowfall and liquid water equivalent, which is critical for preparing winter storm watches and warnings (Alcott and Steenburgh 2010)
- Identifying and predicting high impact weather events (Shafer and Steenburgh 2008, Steenburgh et al. 2009; West and Steenburgh 2010)

Forecasting snow-to-liquid ratio

SCEP Student. Trevor Alcott

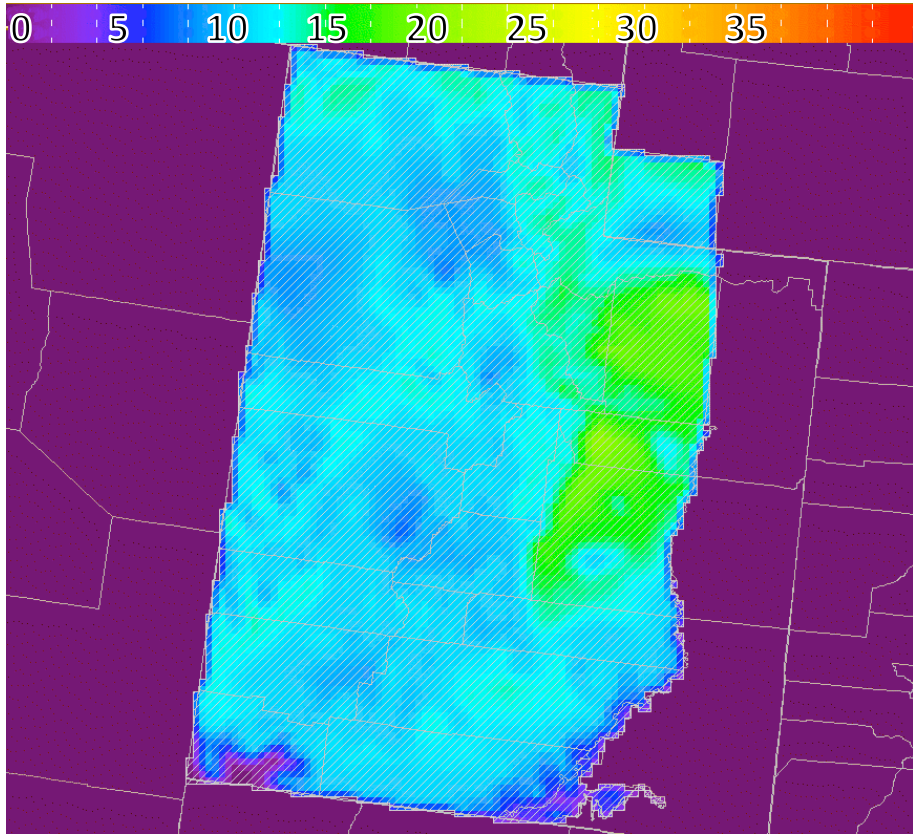
•Climatological study of SLR at Alta and Salt Lake City used to develop SLR algorithm for all of western Utah

• Snow-to-Liquid Ratio Variability and Prediction at a High-Elevation Site in Utah's Wasatch Mountains. Alcott & Steenburgh. Feb 2010. *WAF*

•Algorithm has been coded into a GFE (graphical forecast editor) smart tool to produce gridded forecasts of SLR, and in turn, snowfall amount.

•Replaces use of a single fixed ratio or unskillful empirical methods

•SLR tool is being used by most forecasters at WFO SLC, who report that it is improving (particularly mountain) snowfall forecasts.



6-h SLR forecast valid 25-Dec-2008 6-12 UTC

Contributions Towards Cost Effective Designs for a National Mesonet

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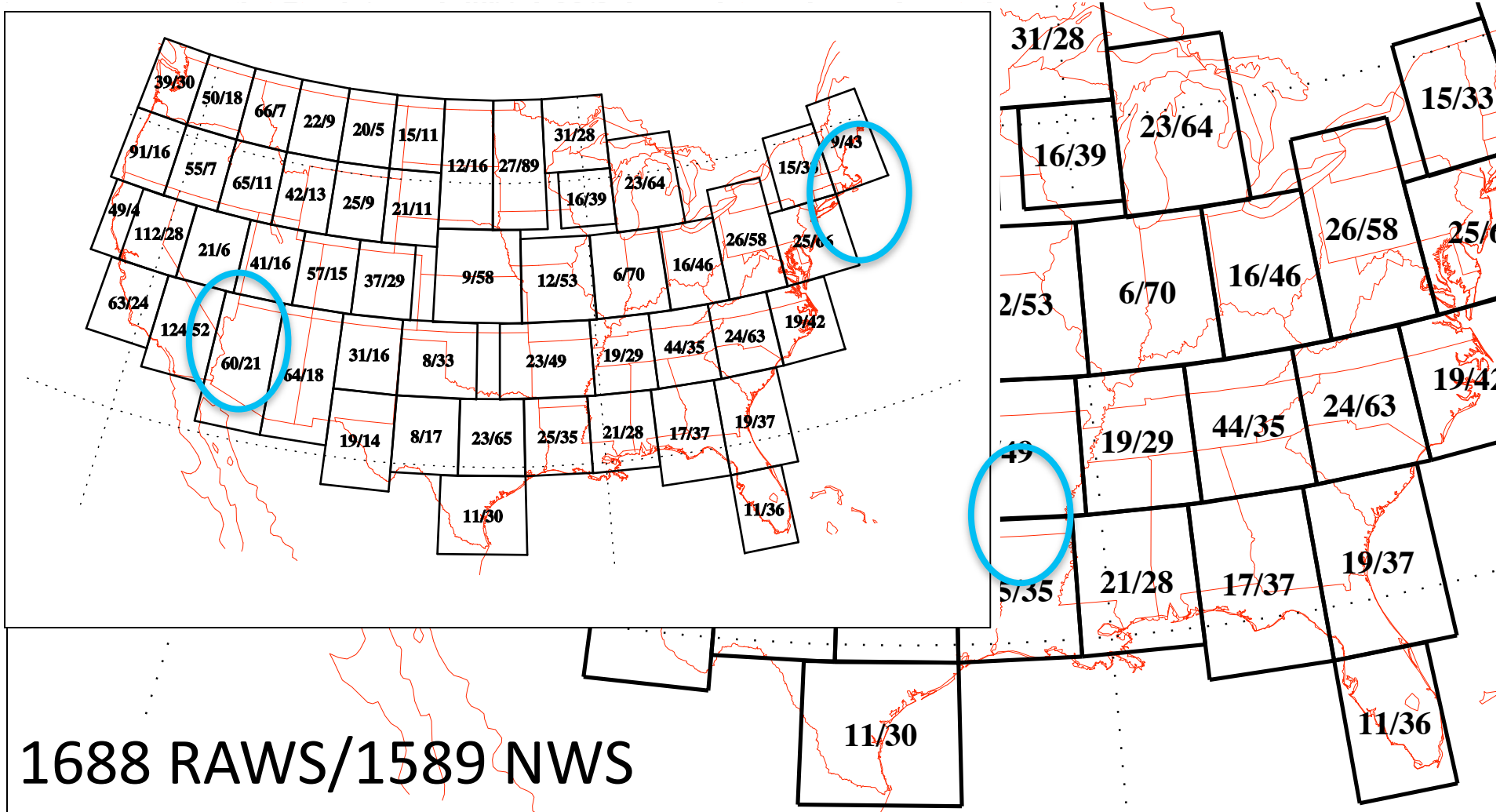
- Horel and Dong (JACM 2010 In Press)
- Provide guidance to land agencies on present distribution of Remote Automated Weather Stations (RAWS) with annual maintenance costs ~$3 million
- Can NWS/FAA observations be used to supplement RAWS network?
- If other RAWS or NWS nearby, could some RAWS stations be less critical than others?
- Apply cross validation to estimate impact of RAWS & NWS observations on analyses of temperature, moisture, and wind

CONUS Subdivided into 51 Domains

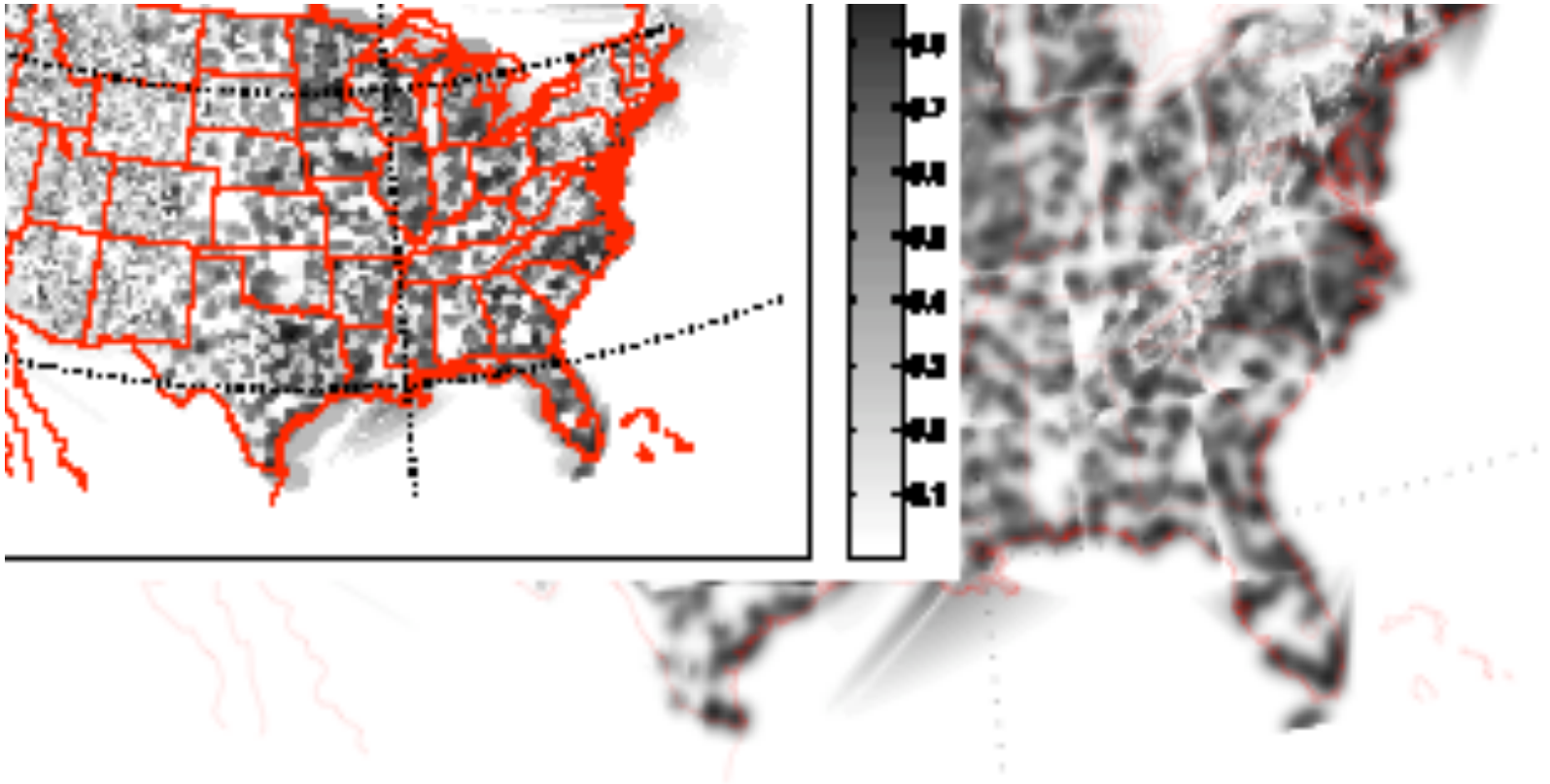


1688 RAWS/1589 NWS

146 pairs of RAWS located within 10 km of one another

127 additional RAWS have NWS station within 10 km

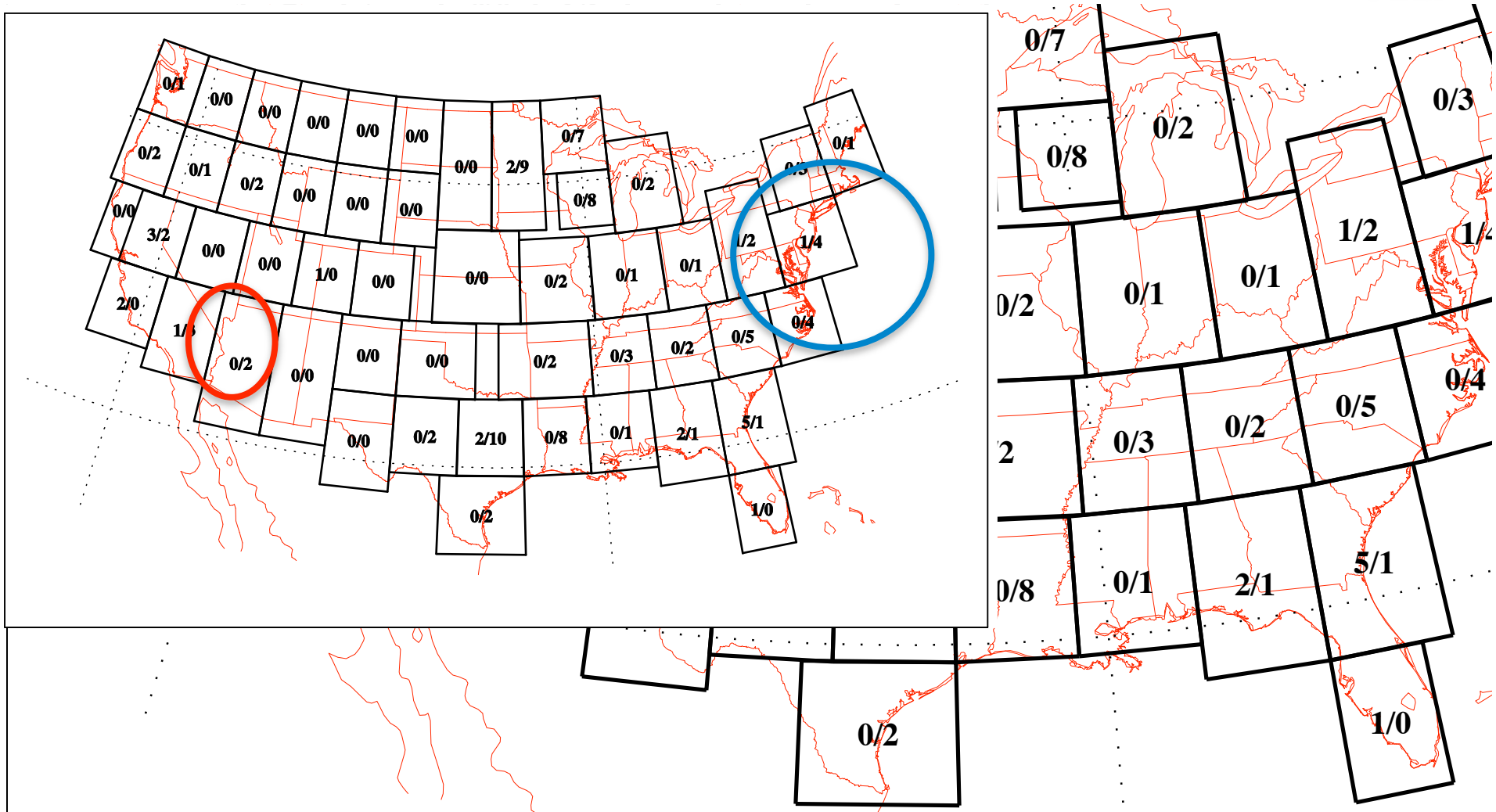
Surface weather remains undersampled by combination of NWS/RAWS



Black- greater influence of NWS & RAWS observations

RRAC1 (RAWS) & KRDD (NWS) Redding CA

Redundant Observations



110 Total Stations Nearby: 22 RAWS/ 88 NWS

Key Points

- All regions of CONUS remain undersampled, especially for observing precipitation
- Very few locations where RAWS stations in close proximity to one another AND adjustments to background field by observations at one could be used as proxies for the other (~20 in CONUS)
- ~90 locations where NWS stations might be considered useful for adjusting conditions in vicinity of existing nearby RAWS stations
- Similar techniques can be applied to examine redundancies and data gaps for national network

Specific Goals: 2010-2013

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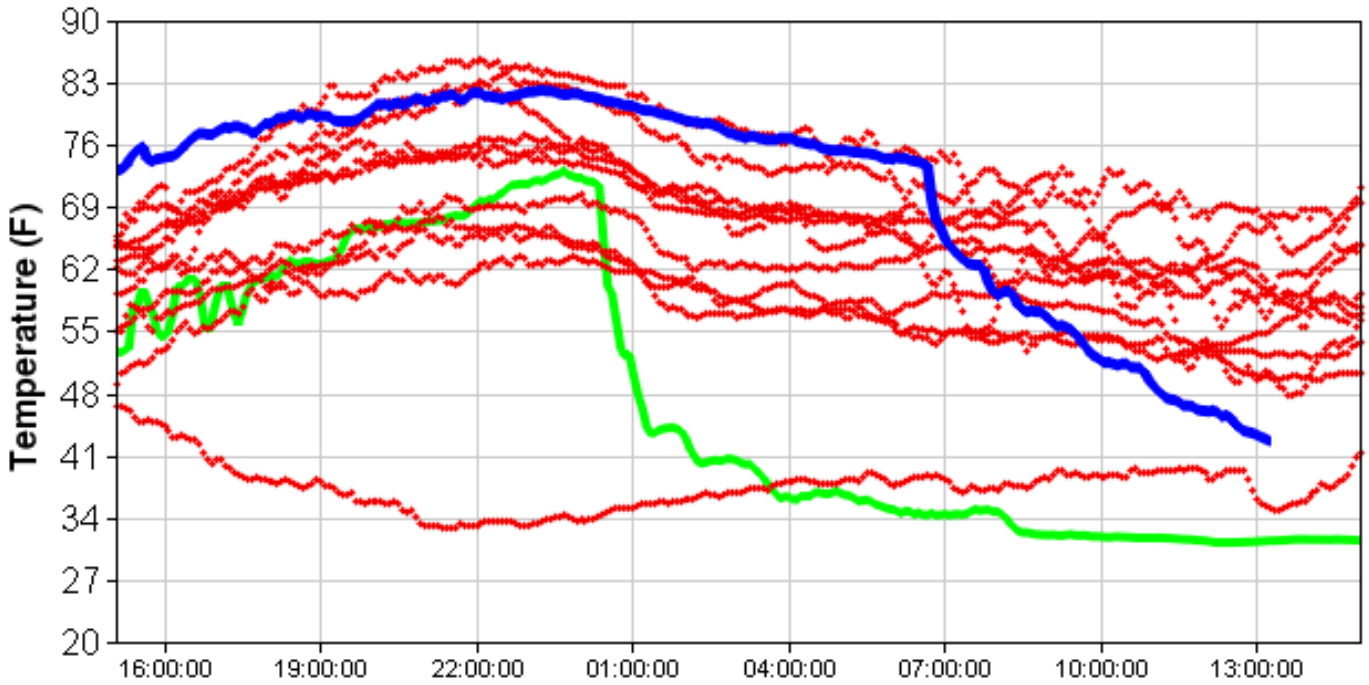
- identify high impact weather events through the continued development of data mining software using MesoWest & MADIS

- improve four dimensional analysis systems through R&D on sensitivity to boundary layer data asssets, quality control procedures, and characteristics of the analysis systems in complex terrain

- advance short-to-medium range forecast capabilities for high-impact weather events over the western United States.

Improving Situational Awareness Through Improved Data Mining Tools using MesoWest/MADIS



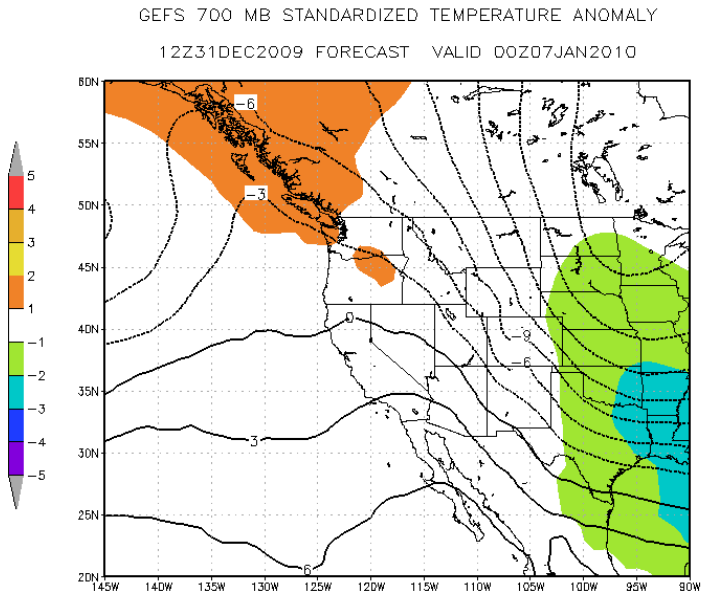
Passage of a strong cold front indicated by the sharp drop in temperature at the University of Utah during 30 September, 2009 (blue line) compared to the temperature on the same calendar day during other years from 1998-2008 (red dotted lines). To aid situational awareness, one of the strongest temperature drops associated with a cold frontal passagae is shown as well (15 April, 2002; green line).

SCEP Student. Trevor Alcott
Standardized Anomaly Graphics/Table

- Created programs to:
  - obtain GEFS ensemble mean forecasts
  - compare to NCEP/NCAR reanalysis climatology created by Rich Grumm (WFO State College, PA)
  - plot standardized height, temperature, wind, moisture anomalies for hours 0 to 180

- Worked with other WFO personnel to create situational awareness table highlighting periods of large standardized anomalies.

- Table and graphics currently used by nearly all Western and Alaska Region WFOs



	Hour:	0	6	12	18	24
Temperature	1000 mb	0.2	0.6	2.1	3.0	3.0
	925 mb	0.2	0.7	2.4	3.4	3.4
	850 mb	0.3	0.8	2.6	3.8	3.8
	700 mb	0.3	0.8	3.0	4.2	4.2
	500 mb	0.3	0.9	3.3	4.7	4.7
	250 mb	0.4	1.1	3.7	5.3	5.3

Summary

- Transition plan for MesoWest to NWS operations being developed
- Planning for national “network of networks” requires assessing impact and value of existing networks
  - Emphasis so far has been to generalize about the value of some mesonets relative to others
- More OSE & OSSE R&D would help to address the value of adding stations and networks
- Development of Analysis of Record critical for needs of WFOs as well as myriad applications, including GEOSS